# Space Weather Technical Forecast

Issued on Thursday, 03 November 2022 at 12:59 Local

**This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

**Space Weather Forecast Headline: Chance of G1/Minor Storms from later on day 1 into day 2 (3rd/4th November). Likelihood of Active electron fluence.**

**Analysis of Space Weather Activity over past 24 hours**

**Solar Activity:** Solar activity has been Low over the last 24 hours. The five active regions on the disk are all magnetically simple, stable and relatively inactive. There have only been relatively small changes to these regions over the past 12 hours. No Earth directed CMEs have been identified.

**Solar Wind / Geomagnetic Activity:** The solar wind, observed by ACE/DSCOVR at L1, has been slightly-elevated for much of the period, averaging between 450-500 km/s. The peak was 564 km/s at 02/1929 UTC. Density was mainly average or below average. Total magnetic field strength was predominantly moderate around 10 nT. The north-south component, Bz, has varied weakly, though did dip to -9nT briefly, with a negative bias through much of the period. Phi angle was mainly positive (Away from the Sun) with brief transitions into the negative sector. Geomagnetic activity was Quiet to Active (Kp 2-4).

**Energetic Particles / Solar Radiation:** The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2 MeV) at GOES-16 has been at moderate or high levels on a diurnal cycle, with a peak of 6.47e3 at 02/1500 UTC, before sharply decreasing to background at 03/0840 UTC. Electron fluence levels have increased above the Active threshold but are now on a slightly declining trend.  1.09e8 integrated pfu was observed at 03/0001 UTC.

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# Met Office Space Weather Technical Forecast

**Four-Day Space Weather Forecast Summary**

**Solar Activity:** Solar activity is likely to be Low or Very Low, with a slight chance of isolated Moderate activity as further active regions are due to rotate onto the visible disc.

**Solar Wind / Geomagnetic Activity:** No Earth-directed CMEs are forecast. The Earth is under the influence of a high speed stream from coronal hole 38. This may subside a little on day 1(3rd November), but it is expected to be quickly followed by an anticipated connection to the high speed stream from coronal hole 39, late on day 1 (3rd) into day 2 (4th November). This feature is currently forecast to produce speeds in the region of 600 km/s. Geomagnetic activity will be mainly Quiet to Unsettled through much of the period, but with a likelihood of Active intervals on days 1 and 2 (3rd/4th) and a chance of G1/Minor Storms also on days 1 and 2 (3rd/ 4th of November).

**Energetic Particles / Solar Radiation:** The high energy proton flux (greater than 10 MeV) observed by GOES-16 is expected to be at background levels. High energy electron flux (greater than 2 MeV) observed by GOES-16 is forecast to return to moderate to high levels through the period. The associated 24 hour electron fluence is expected to continue close to or just above the Active (1e8 integrated pfu) threshold.

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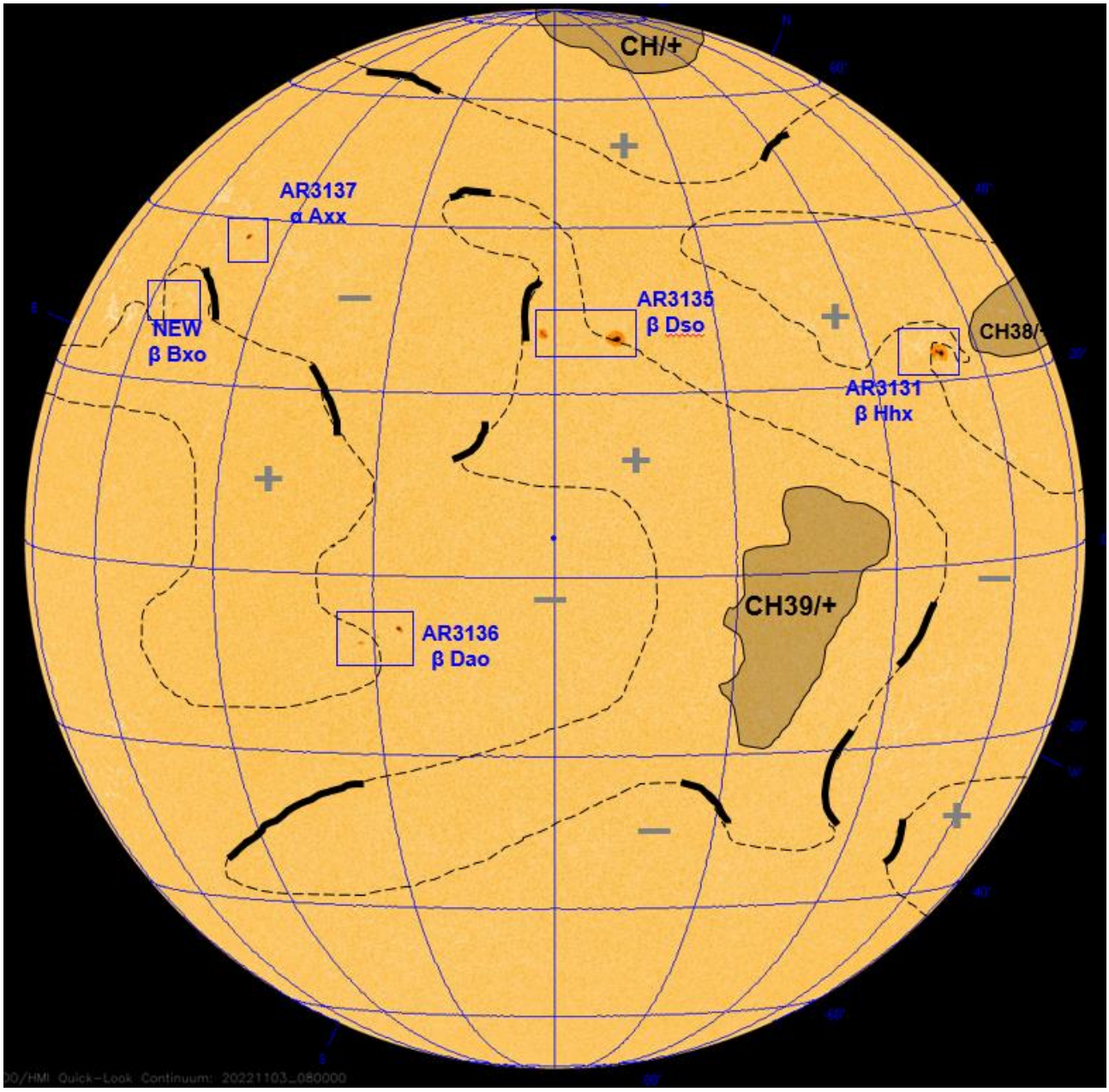
**Figure 1. Solar Analysis Valid 03/0800 UTC.**

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**Key:** Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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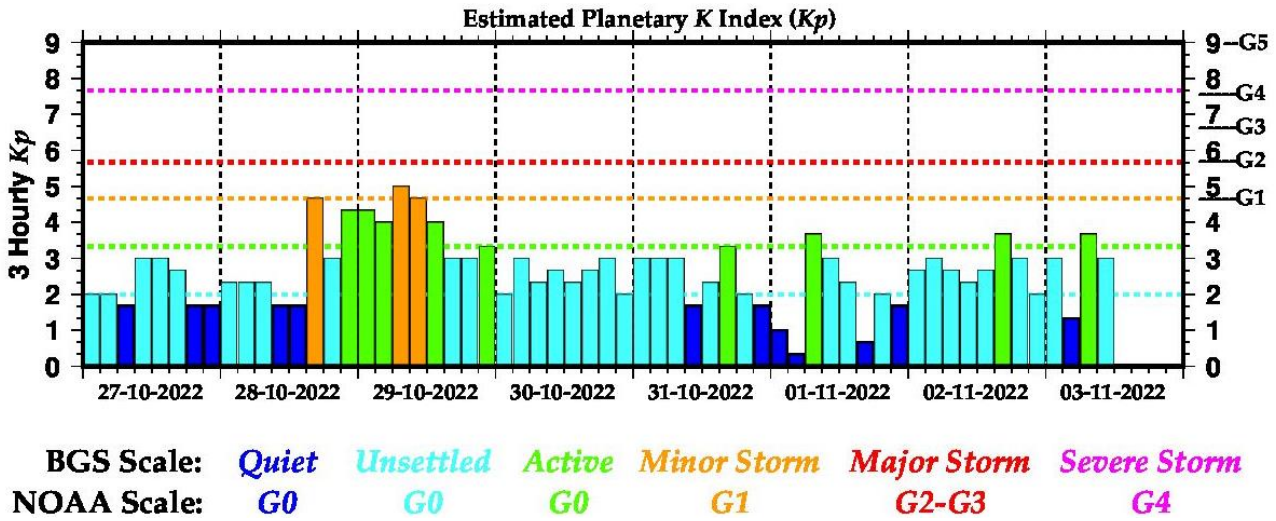
## Geomagnetic Storms:

No Earth-directed CMEs are currently forecast.
Earth appears to be currently connected to the high speed stream from coronal hole 38. The winds associated with this feature may ease briefly on day 1 (3rd) before a likely stronger high speed stream from coronal hole 39 connects with Earth later on day 21 or early on day 2 (3rd/4th). Speeds from this feature may reach 600 km/s at times. This feature appears much larger than on its previous rotation.
Geomagnetic activity is forecast to be mainly Unsettled, with a likelihood of further Active intervals and a chance of G1/Minor Storm intervals on days 1 and 2 (3rd/4th). Activity should ease back to mainly Quiet to Unsettled from day 3 (5th).

| Geo-Magnetic Storm<br>Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC)<br>(%) | Day 2 (00-24 UTC)<br>(%) | Day 3 (00-24 UTC)<br>(%) | Day 4 (00-24 UTC)<br>(%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | No | 40 | 40 | 25 | 20 |
| Strong | G3 | No | 1 | 1 | 1 | 1 |
| Severe | G4 | No | 1 | 1 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

## Geomagnetic Activity - Earthbound Coronal Mass Ejections- Nil

**Figure 2: BGS Kp index**

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## Radio Blackouts - X-Ray Flares:

There are five sunspot regions on the visible disc. All inactive and relatively simple. None of the regions have shown any development over the past 12 hours. Far side data suggests that a number of significant active regions could rotate into the visible disc over the next four days, including ex-AR3122 which was a large, active sunspot on the previous rotation.
Solar activity is expected to be mainly Low or Very Low, but with a slight chance of Moderate activity throughout. These probabilities will be re-assessed if new regions emerge.

| X Ray Flares | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|---|---|---|---|---|---|---|
| Probability | | | (%) | (%) | (%) | (%) |
| Active | R1-R2 M Class | No | 10 | 10 | 10 | 10 |
| Very Active | R3 to R5 X Class | No | 1 | 1 | 1 | 1 |

## Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) at GEO, observed by GOES-16 is currently at background and is forecast to remain at this level through the guidance period.

| Radiation Storms | Level ($cm^{-2}$ $sr^{-1}$ $s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|---|---|---|---|---|---|---|
| Probability (Exceedance) | | | (%) | (%) | (%) | (%) |
| Active | ≥ S1 | No | 1 | 1 | 1 | 1 |
| Very Active | ≥ S3 * | No | 1 | 1 | 1 | 1 |

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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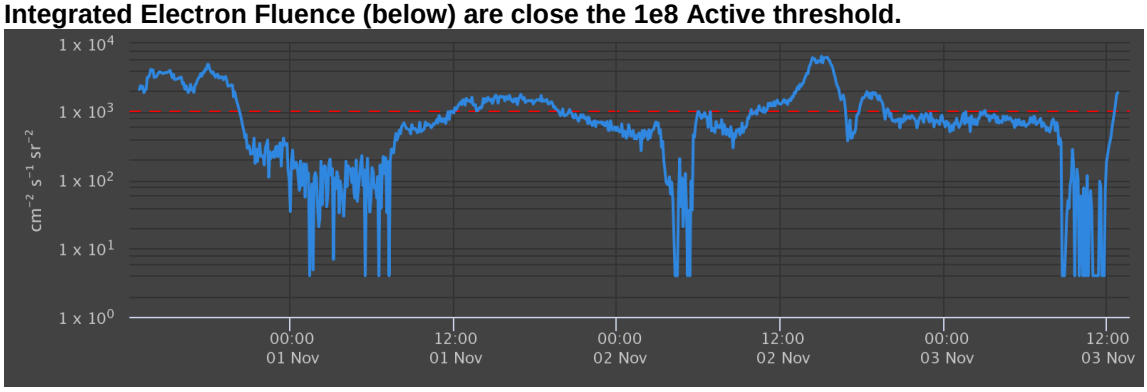
**High Energy Electrons Event (≥ 2MeV):**

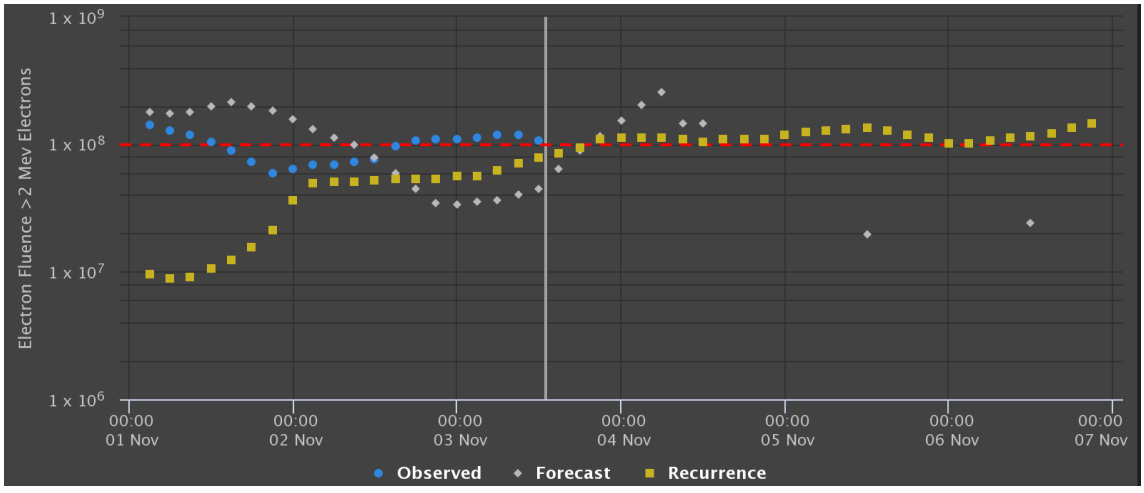
The high energy electron flux (greater than 2 MeV) is currently oscillating through moderate to high levels on a diurnal cycle. This pattern is expected to continue through the period, based on electron belt models with the radiation belts receiving a feed of electrons from the recent high speed streams. There is a likelihood that the onset of a further high speed stream either late on day 1 or early on day 2 (3rd/4th November) could be strong enough to distort the belts out of their natural orbits and lead to a dip in the flux, with a sharp recovery as the belts relax later in the period as the potential strong solar wind eases.

Electron fluence has followed an upward trend after falling just below the Active threshold in the last 24 hours. The longevity of this trend is uncertain, but there remains a continued risk of the fluence exceeding the Active threshold over the next four days in the high electron flux environment.

| GEO Electron Environment | Level ($cm^{-2}$ $sr^{-1}$ $day^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|---|---|---|---|---|---|---|
| Probability (Exceedance) | | | (%) | (%) | (%) | (%) |
| Active | ≥ 2 MeV ≥ $1x10^8$ | Yes | 70 | 50 | 50 | 70 |
| Very Active | ≥ 2 MeV ≥ $1x10^9$ | No | 1 | 1 | 1 | 1 |

**Figure 3: GOES16 ElectronFlux (top) has been reaching High levels at the diurnal maximum. Integrated Electron Fluence (below) are close the 1e8 Active threshold.**

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